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AUTHOR Strong, Merle E.
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ABSTRACT

Based on a review of the literature on industrial education as well as on comments elicited from industrial educators, it does not appear that the topics for research in industrial education have changed much throughout the years. What has changed, however, is the context in which industrial educators operate. In light of these changes, it would appear that an agenda of topics for research on industrial education should include the following broad areas: curriculum, evaluation, support of basics, instructional organization, and instructional methods. While the topic "curriculum" is broad and contains many studies using many kinds of methodology, it would seem that a significant number of studies need to be qualitative as opposed to quantitative in nature. As the movement to establish greater quality and rigor in educational programs gains momentum, the whole area of evaluation research will become increasingly important. Included among the many topics requiring research in the broad areas of instructional organization and methods are the characteristics of successful schools, ways to maximize the efficient and effective use of computer hardware in instruction, and strategies for developing and enhancing linkages between the business and educational sectors. (MN)

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RESEARCH PROBLEMS UNIQUE TO INDUSTRIAL EDUCATION

By
Merle E. Strong

This opportunity to make a presentation on research problems unique to industrial education has been taken quite seriously. I have reviewed a good amount of literature and perhaps, more importantly, I have talked to a number of colleagues about the challenge. One conclusion that I have come to is that the questions that are paramount remain about the same as they were some forty plus years ago when I became a student in the field. It is really only the context that has changed. By this I mean our society is different in many ways, but probably most importantly, for those of us in industrial education, is the change in technology.

In order to put some of these changes into perspective, it is of interest for one that has been around a few years to reflect on just how far we have come in a few short years. In terms of communication, Morse code was being taught in the college I attended. Television was not really available until I had about five years in teaching. The jet age really didn't begin until after I was in the U.S. Office of Education. I can remember our mutual friend, Jack Walsh, wrangling an early commercial flight from Baltimore to Los Angeles in 1958. At that time there was a surcharge to fly a jet, and it wasn't clear whether the Government would stand the extra expense. Computers were not available for use yet for students in education, at the time that I finished my doctorate, and it probably took a building to house the computing capacity that one can now carry under one arm.

We are really in a new technological era. Naisbitt's Megatrends, which you should all have read, is not very startling to those of us in industrial education, but it does point out directions in which we are already headed. Each day around us technology is changing. The basic question which I believe we must ask is, "Is Industrial Education changing to reflect the new industrial environment?"

This is not a new question in that it was being asked some forty years ago when I started in industrial education. However, I'm not sure that we have ever answered the question and, obviously, the answer should be under continued review and revision. Some place in this Nation, I would guess that someone is still making that window stick or foot stool like the one I made over forty years ago in industrial arts. It was probably not too appropriate then and is certainly less so now, but, sadly enough, someone may still be trying to defend it as the good project that it might have been at some time in the ancient past.

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Need for Definition

It seems appropriate to dwell, at least momentarily, on the problem I believe we have related to purpose and definition in industrial education. All of us agree that industrial education is a broad generic term that encompasses industrial arts, trade and industry, and technical education. From here we get a bit fuzzy, in my opinion, which makes communication with our publics very difficult. The breadth of the VED's reporting system, organization at the state and local levels, and other factors, have led some to think of all industrial arts to be justified on the basis of being vocational, which I believe understates the purposes of industrial arts as a part of general education. On the other hand, vocational educators claim a very broad swath of responsibilities for trade and industrial education including something called general-vocational education.

It is not my purpose to solve this problem of terminology here, and I believe that it is more likely to be influenced and, hopefully, clarified in the political arena than by research, yet I believe that definitions, goals, and objectives are very basic to any research effort; also, that they may very properly be the subject of research. I commend the developers of the "Standards for Industrial Arts Programs" which have been published recently, because these standards reflect somewhat on this problem. Also, the standards to be developed on trade and industrial education, hopefully, may also be of some help.

The Educational Context

The context in which we find ourselves is quite interesting. First, a White House that has been committed to lessening the Federal role in all education, but at the same time, there is a new awareness among many publics of the value and need for a strong educational system. Most of you, I am sure, have read some of the numerous national reports on education such as, A Nation At Risk, High School: A Report on Secondary Education in America, and Action for Excellence, to name a few of what may be the most influential. I mention these reports because I believe that they will have a profound influence on public opinion, on the opinions of professional educators and, ultimately, on program direction, particularly at the high school level. After reading these reports, a pessimist would certainly say that the reports are not constructive to industrial education, particularly at the middle school and secondary levels. With all of the emphasis on the basics, usually defined as requiring more years of English, math, and science, there is just no room for industrial education.

My position is that we should be optimists. Obviously, we should be raising the basic skills levels for all students; obviously many of our programs in the public schools are without rigor, and obviously, we get many students in both our high school and post-high school programs without good basic skills. Wouldn't it be great if all of our students came to us with excellent reading levels and substantial math and science skills.

A part of our research agenda then, I believe, should be to address ways that we in industrial education can become a central part of the national agenda for excellence in education.

Let me comment on a few of the references from the Carnegie Report (Boyer, 1983).

> Education is in the headlines again. After years of shameful neglect, educators and politicians have taken the pulse of the public school system and found it faint (p. 1).

> This Carnegie Report on the American high school begins with the conviction that the time for renewing education has arrived. We believe today that America has the best opportunity it will have in the century to improve the schools (p. 1).

The above quotations certainly suggest the challenge and, hopefully, the opportunity. The problem with the Boyer report, in my opinion, is that it may be somewhat elitist and very idealistic. In fact, it may fail to recognize that there are great individual differences among students and among occupational requirements.

I thought I had found a friend and good supporter of industrial education when I discovered a sub-heading in the report, "The Impact of Technology." Then I realized as I read further that the report was talking about the same sort of history, several decades advanced, that I studied in the upper grades, except I studied about the reaper and the cotton gin. Let me again quote briefly from the report:

> We recommend that all students study technology: the history of man's use of tools, how science and technology has been joined, and the ethical and social issues technology has raised (p. 10).

> The great urgency is not "computer literacy," but "technological literacy," the need to see how society is being reshaped by our inventions, just as tools of earlier eras changed the course of history. The challenge is not how to use the latest piece of hardware, but asking when and why it should be used (p. iii).

> The one semester study of work we propose would ask how attitudes toward work have changed through the years. How do they differ from one culture to another? What determines the status and rewards of different forms of work? In addition, students should learn about changes in the economy, job opportunities that are emerging, and those that are declining (p. 114).

I would not argue that the above content is not desirable, but rather that it does not go far enough. The report recommends that we teach about technology and about work. I believe we should also teach technology and skills and how to work.

A Research Agenda

As I mentioned earlier, I do not see that the topics for research in industrial education have changed much throughout the years. It is, rather, the context has changed in which we operate and, therefore, the answers to many of the questions that we pose should change. I would propose that we need research in, at least, five broad areas and I will attempt to identify some topics rather specifically. The areas that I would suggest are as follows: Curriculum, Evaluation, Support of Basics, and Instructional Organization and Methods.

Curriculum Development

The most basic question facing industrial educators is what should be taught. Industry has always been the basic focus for content, however, we may be a little like the blind man touching the elephant as we attempt to view industry.

I would commend a recent bulletin resulting from a recent study by Richard Swanson and others entitled, A View of Industry (1983). Industry is described from the literature and a model of industry has been proposed, useful for determining content in industrial education. This study is a good beginning in the development of a rational way of viewing industry for curriculum purposes.

What should be taught in industrial arts? The data collected in the "Industrial Arts Standards Project" showed that course offerings had changed little since 1950 (Worthington, p. 71). The five top courses were woodworking, general metals, general industrial arts, architectural drafting, and mechanical drawing. The question is, to what extent do these courses represent today's technology, assuming that this is a central objective of industrial arts? If industrial arts is a study of the tools and processes of industry, research is needed to identify the content from industry that can be incorporated into an industrial arts curriculum.

This topic is, obviously, very broad, and there is room for many studies on the general topic using various kinds of methodologies. It would appear that many of the studies need to be qualitative in nature as compared to quantitative. The resource for the data will need to be found in industry itself. Some of the new technologies should, obviously, be the focus; however, I would caution that while high tech is the buzz word, data will show that many will not be working in these areas; therefore, it will probably be desirable for industrial arts to reflect the broader work area. In trade and industrial education related to curriculum, we continue to have the same kinds

of questions that have faced us for some time. What are the manpower needs in a district or region? While we have much data on a national and state basis, it is often not too helpful in a particular region. Also, we are a long way from having definitive information needed for program development in most cases. Models for determining manpower data for program planning purposes need further development and testing.

What is the criticality of training? - In other words, once we have manpower data, what are the criteria for determining what occupations we should invest in? Cost benefit analysis was very popular at one time and still has its place, but is there not a need to develop broader models which might include such criteria as, how important the occupation is to the society.

What are the changes that should be made in programs? I have the strong belief that most of the change in trade and industrial programs will be and should be incremental-type changes as compared to changes of the total curriculum. We need continuing research in industrial areas to determine what should be added to programs to keep up with industrial practices and just as important, what should be left out.

How can we best serve individual differences? Competency-based, individualized, mediated instruction is expanding at a rapid rate. Research is needed to determine its most effective use for which individuals, under what circumstances. There is, at least, empirical evidence that it can be made more efficient than traditional instruction using the open entry-open exit system.

Evaluation

I predict that the whole area of evaluation will become a more important area of research as we seek to establish quality and rigor in programs. National assessments of various kinds will take on new importance as will testing systems initiated by states.

I believe the Occupational Competency testing program in trade and industrial education should be expanded and more fully used. One method of determining how our students compare is to match their achievement scores with others on validated content of an occupation. Research is needed then to determine what the factors are that will upgrade programs. What is the effect of time on task? What is the effect of shortcomings in facility? What is the effect of teaching related math and technology classes as compared to less applied content? What instructor qualifications have an effect on learning?

Follow-up studies, particularly on a longitudinal basis, are greatly needed. I am appalled by the fact that at the secondary level, it is hard to find a school that has follow-up information on high school students, except those in vocational education. We just don't know what happens to our high school graduates not to speak of the dropouts, except in a general

sense and some of what we think we know isn't always true. The implications of good longitudinal studies are great for the improvement of program and instruction.

What has been the impact on Federal support? We say we need it, and I agree. Yet we don't have much research that provides definitive evidence of the effect it has had. Yet, I believe both qualitative and quantitative type information can be collected.

Organization and Method

The areas of organization and methods are fruitful areas for research. In terms of types of schools, several studies have indicated that the most successful vocational education programs were not in comprehensive high schools, but rather in specialized high schools (Boyer, 1983).

These facts would suggest that we should research the characteristics of successful specialized schools. What are the variables that make their programs more successful? Among these may be: time alloted, student selection, curriculum, teacher qualifications, facilities. This research would not necessarily be to make the case for specialized schools, but rather would be for the purpose of identifying the ingredients that may be missing from the comprehensive high school.

There is a continuing concern that the basics not be sacrificed for vocational education. Has anyone researched the scores of students in intensive vocational programs, as compared to students in the college preparatory or general program, controlling for ability? Such research might show that trade and industrial students have not sacrificed the basics, or it might show that our related instruction, which should be based on principles of math and science, really lacks rigor.

The age of microcomputers has arrived, at least, from a hardware standpoint, although hardware will certainly continue to be improved. I would posit that we know too little about how to utilize this new hardware for maximum efficiency and effectiveness. Recently, I heard someone decry the fact that they had new computers, but 20-year-old test books. The need for research in the use of micros and other instructional media as a way of delivery of instruction is great.

Linkages with Business and Industry

Linkages with business and industry are seen by many as the promising way to excellence. Private Industry Councils are the driving force behind new manpower programs and Business School Partnerships have many advocates.

One of the statements of the Task Force On Education and Economic Growth was, "If the business community gets more involved in both the design and the delivery of education, we are going to become more competitive as an economy." (Hunt, 1983, p. 18).

I'm not at all sure business and industry have a lot of easy solutions for education. However, industrial educators have been more attuned to business and industry than has been the rest of education, particularly through the use of advisory committees.

Research is needed to determine how best to establish linkages. What are the successful ingredients of a successful linkage? How can we most successfully secure the advice and council of industry representatives? What level of dollar incentives or tax incentives are required to bring about a sharing of the use of industrial facilities and equipment?

What kinds of technical assistance can be provided to industry, and on what basis? Many of our schools have been in a posture of only providing training through organized classes, usually with a limit such as 10 or 12. I believe we need to find ways to be more flexible. Some post-secondary institutions are now providing one-on-one technical assistance.

There would seem to be a need to strengthen links to Private Industry Councils. Occupational Advisory Committees may provide one means for doing this. I believe linkage models need to be developed and tested.

Industrial educators have the potential because of past experience to research most effective linkage methods and to lead the way for all education.

Support of the Basics

There is not a clear understanding of what is meant by the basics. It is agreed that the basics include reading, writing, and computational skills, but there is less agreement about what the minimum levels should be and for whom. Computers have now been added to the list of basics by at least one study group. Some are suggesting that only transferable skills should be taught at the high school level with lists of examples of what is meant. Such lists often include such things as decision-making, creativity, imagination, innovation, conceptualization, motivation, and problem-solving, to name a few.

Evans (1971) in his book on Foundations of Vocational Education included a chapter entitled, "Lending Intelligibility to General Education," which provides rationale for thinking about vocational education as a method of instruction. I believe that for many youth the academic approach lacks meaning, and that academic skills for many students can better be taught through application. Industrial education can provide that application of math and science, particularly, if properly taught. I'm relatively sure that I will get no arguments on this point from industrial educators. However, I do not know of research that backs up this position.

The survival of industrial education is somewhat dependent on demonstrating that the 3R's can be learned through practical application. My plea is that every class at all levels, high school or post-high school, be an applied English class, math class, and science class. This will not happen automatically.

Curricula will have to reflect this. Some industrial education teachers may need additional preparation, and there will need to be a commitment to the task. For many students, 11 years of English has not made much of an impact. The solution may not be to add another year of the same, but we need some answers from research.

In terms of the descriptors of generalized skills mentioned earlier, I don't think that general education has a monopoly on teaching students to solve problems, be innovative, to conceptualize, or, even to think. However, we need curriculum research that will point up the means for doing a better job in these areas and evaluative research that will indicate to us when we have been successful.

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